

Wireline Cone Penetrometer System for Multiple Tool Usage

Technology Need:

Since the late 1980's, many new sensors and “tools” have been developed for cone penetrometer technology (CPT), greatly expanding its capabilities for environmental characterization. Such tools include, various chemical, radiological, and geophysical sensors; soil, soil-vapor, and groundwater samplers; and down hole video. Using conventional CPT, the entire rod-string (the series of rod sections that make up the CPT rod) must be extracted from the hole to change the sensor or “tool” being used at the tip. Collecting soil samples with conventional CPT also requires the entire rod-string to be retracted for each sample collected. This slow process of removing and redeploying the entire rod-string is inefficient and expensive. An efficient method is needed to exchange CPT tools with out removing the entire rod string from the ground. Such a system would allow end-users to take full advantage of the wide range of tools and sensor available for CPT.

Technology Description:

Applied Research Associates, Inc. (ARA), has developed an innovative Wireline CPT system that allows sensors and tools to be exchanged in a rapid manner without retracting the rod string. The Wireline CPT system consists of an innovative locking/retrieval system and an assortment of characterization tools that can be retrieved and interchanged from any depth. The name Wireline is derived from the wire cable that is attached to each tool for the purpose of retrieval. The Wireline system utilizes slightly larger rods than conventional CPT, allowing passage of tools through the hollow center of the rod.

The Wireline CPT system consists of three main components and three characterization tools:

- ▶ Specialized, high strength, fast coupling rod string;
- ▶ Tool locking and retrieval mechanism; and
- ▶ Individual characterization tools (small diameter (1.125 in) piezocone; retrievable soil sampler; and grout module.)

The first tool is a standard piezocone for determining soil type, stratigraphy, and soil strength characteristics. The second tool is a soil sampler that collects and retrieves core samples 1 in. in diameter by 12, 18, or 24-in. long. The soil sampler is shown in Figure 2 on the back of this page. The third tool is an attachment to permit grouting of the penetration hole during retraction. The full potential of the Wireline system will be realized as a full assortment of CPT tools is adapted to the Wireline system. A rendering of the Wireline system and tools is shown in Figure 1.

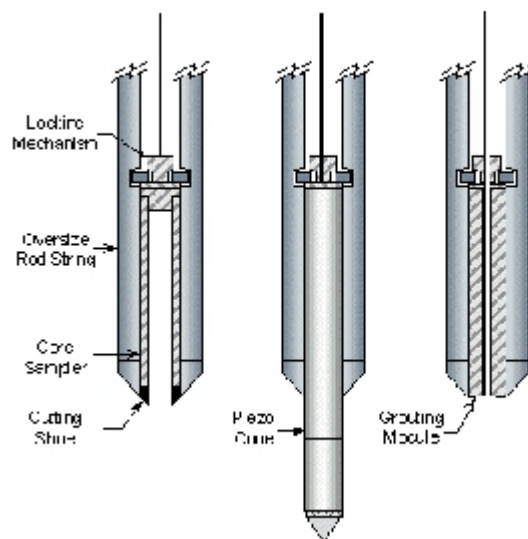


Figure 1: Wireline CPT tool: Soil Sampler, Piezocone, and Grouting Module.

Benefits:

- ▶ Wireline CPT tools can be exchanged without retracting the rod-string, significantly reducing the time and cost of site characterization tasks.
- ▶ System allows all characterization work to be accomplished in a single penetration.
- ▶ Soil samples can be retrieved from multiple depths without retracting the rod-string.
- ▶ System has grout out capability, minimizes chance of contaminant migration.

For contiguous soil sampling, the Wireline CPT offers significant cost saving over the sampling by conventional CPT. At depths ranging from 50 to 150 feet, the cost of using the Wireline CPT system is 60 to 80 percent less than the cost of conventional CPT. While the cost savings demonstrated for contiguous soil sampling are significant, the greatest cost savings from use of the Wireline CPT system will probably be realized in mixed applications, such as a combination of sensor characterization and sampling.



Figure 2. Soil Sampler

Status and Accomplishments:

This project was completed in November, 2000. The Wireline system is widely considered a significant breakthrough in CPT and is commercially available through ARA. The Wireline CPT was successfully demonstrated at Savannah River Site's (SRS) M-Basin and has since been deployed multiple times at other areas of SRS and at the Hanford Site. Westinghouse Savannah River Company and Bechtel BWXT Idaho have purchased Wireline systems for ongoing characterization work at these sites.

In addition to the three characterization tools developed during this project, ARA has also developed

a Wireline soil gas sampler, and a "dummy tip" for quickly advancing to the desired sampling depth without risking damage to a more expensive tool. The ribbon DNAPL sampler was also successfully utilized with the Wireline system at SRS.

In 2001, ARA was awarded a new project with DOE's to develop and an Enhanced Access Penetration System for difficult geological settings. This project involves integrating overburden drilling, and laser drilling with the Wireline CPT to allow penetration of difficult geologic layer, such as Hanford's cemented Caliche layer. This layer was not penetrable by conventional CPT or the Wireline system with the sonic CPT attachment. For more information on this project see the technology data sheet entitled "Enhanced Access Penetration System", TMS Tech ID 3156.

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Office of Science and Technology, Technology Management System (TMS), Tech ID # 2222
<http://ost.em.doe.gov/tms>

The National Energy Technology Laboratory Internet address is <http://www.netl.doe.gov>

For additional information, please visit ARA's website at <http://www.ara.com/>

An Innovative Technology Summary Report (ITSRs) for the Wireline CPT is available at <http://apps.em.doe.gov/ost/itsrindp.html>